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Chan, L. et al 2002. *Budapest Open Access Initiative*. New York: Open Society Institute. Available at: <http://www.soros.org/openaccess/read.shtml> [Retrieved 22 January 2007].

# Reinventing classroom space to re-energise information literacy instruction

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## Abstract

Librarians in academic settings spend a significant amount of time teaching students information literacy skills. Teachers adapt their teaching activities to the constraints of the physical setting of the classroom. Brigham Young University's Harold B. Lee Library modified a classroom from a traditional lecture room to a room where the seating was mobile. The teachers and students were observed and surveyed to see if the change in physical environment impacted the teaching style or learning activities used. The findings indicate that teachers use familiar routines and lessons in both a traditional lecture-style classroom and a newly-designed flexible learning space as they present information literacy instruction. Teachers who recognised that students benefited from learning activities where they were active participants were more likely to incorporate small changes to their lesson plans. The classroom design can re-energise instruction if the teacher adapts their teaching style to the more flexible learning environment.

This article is based on a paper presented at LILAC 2012.

## Keywords

information literacy; library instruction; flexible learning space; classroom design; classroom environment; collaborative learning; active learning; teaching techniques; Apple iPad

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## 1. Introduction

Librarians in academic settings spend a significant amount of time teaching students information literacy (IL) skills. They are dedicated to improving student learning and desire to become excellent teachers. However, one consideration that is seldom addressed is the classroom environment. As teachers prepare their lesson plans, they prepare the content and presentation of the material but often, do not consciously think about the classroom environment and its impact on student learning. There are perhaps two explanations why the classroom environment is not considered. Firstly, it has such a minor impact on the content that it is not worth the time to think about or change. Secondly, the classroom configuration is set, thus making the environment the least changeable aspect of the IL class session.

Teachers are recognising the need to replace traditional lectures with activities that engage the students in the learning experience. Class sessions where the teacher uses the time talking about IL skills and demonstrating databases seem to be less effective in engaging students than sessions where students practise the skills, work in teams to solve a problem, and discuss the concepts being presented. The physical aspects of a classroom make a difference in the effectiveness of the learning activities that teachers use. Social interactions between teachers, students, and peers can also be affected by the classroom configuration. As technology changes and as students become more involved in their learning, an effective physical space needs to adapt to the teaching situation rather than requiring the teaching situation to adapt to the space (Weaver 2006).

With the goal of helping teachers improve and energise their teaching practices, the Brigham Young University (BYU) library redesigned a classroom and studied the effects of the change on teacher and student behaviour. The findings indicate that students are more engaged with activities that require them to practise the IL skills; however, teachers are still the most influential element in creating the change needed to adapt to a new classroom configuration.

## 2. Review of literature

As educators focus on student-centred learning and critical thinking skills, librarians must also consider how students learn IL skills (Black and Roberts 2006; Kek and Huijser 2011). Surface learning of key concepts is not enough for students in today's information rich world. Activities that help students collaborate, analyse, interpret, and receive feedback on their work assist students in developing deeper understanding and critical thinking skills (Black and Roberts 2006; Kek and Huijser 2011). Students are social, collaborative, and technologically independent when it comes to doing research (Appleton et al 2011). Watching a teacher stand at the front of the classroom and demonstrate how to search a database is the least engaging activity a student can imagine. When their only introduction to IL skills is conducted in such a class it is not surprising that students often lack enthusiasm for their library sessions. As teachers move towards active learning experiences for students in library instruction sessions, they need to be aware that students have expectations of how they will be taught.

There is evidence that teaching behaviour is shaped by the physical space and that while a teacher may recognise the need to adapt his or her teaching methods, the space may constrain those changes. Habits are formed as traditional classroom designs are repeated in various teaching settings. The teaching behaviours become so ingrained that the curriculum is designed for the space rather than redesigning the space to better meet the learning outcomes. Researchers in a recent study found that rearranging classroom furniture was time consuming and difficult. Rather than taking the time to reconfigure the tables and chairs, teachers and students adapted their activities to the space (Woolner et al 2012). Furniture that can easily be reconfigured to the space solves this problem. This is also supported by research conducted by Wannarka and Ruhl (2008). They reviewed research studies on classroom seating arrangements for children aged 7 to 15 years old. They concluded that while student behaviour may be influenced by the seating arrangement, it was best to focus on the task and arrange the seats according to the teaching needs, thus encouraging the appropriate behaviour for the task.

Changes to traditional teaching can be as disorienting to the student as it is for the teacher (Weaver 2006, p.121; Smith 2004). Successful changes to a flexible learning classroom will depend on how well the teacher orients the students to the experience and how engaged the students are in the activities. One measure of student engagement is the amount of relevant conversation that occurs during the library instruction session. This concept was supported by a recent research study conducted by Whitmore and Laurich (2010). They found that students who used a local video games centre were deeply engaged in their activity and easily learnt new games. Children were noisy in discussing the games, fluid in how they moved from one activity to another and supportive of each other as they learnt. The researchers wondered if these behaviours could be duplicated in a language arts classroom. The results of the study indicated that while the noise level increased when the classroom was rearranged, students were engaged in appropriate language arts activities. They concluded that room arrangement had a positive effect on student engagement (Whitmore and Laurich 2010). In a small research study conducted with university students, researchers found contradictory evidence on whether seat arrangement or personality affected academic performance in a typical university classroom (Parker et al 2011). They concluded that social factors may influence student participation more than seating location in a traditional classroom arrangement with desks arranged in rows.

Creating an environment where students and teachers feel connected to each other is the ideal circumstance for any classroom environment. Researchers at the University of Minnesota discovered that both students and teachers reported increased satisfaction with their relationships to each other when students were placed in a flexible learning environment (Whiteside et al 2009). Sometimes the configuration of a classroom constrains the way a teacher is able to interact with students. A different room configuration can spark creative teaching methods that inspire the inclusion of new content or allow a teacher to freely explore different teaching methods for the same content. In a research study conducted by Burgess and Kaya (2007) they found that 'row-and-column seating makes the teacher the primary focus in the classroom, while cluster-type layouts...give attention to other students and can foster a sense of community, encourage participation, and contribute to socialization skills.' Thus, if physical barriers can be removed from a classroom setting, teachers will have an increased ability to be more innovative in their instruction and students will find it easier to work together and mentor each other.

The change to an instructor's established way of teaching can be modified by the environment of the classroom. In the study conducted at the University of Minnesota (Whiteside et al 2010), researchers found that when teachers attempt to teach the same way in a flexible learning classroom or a traditional lecture room, their teaching style changes based on the room they are in. The researchers observed the teachers delivering the same lesson in both types of rooms. They discovered that teachers lectured more and stayed more at the front of the class in the traditional classroom than they did in the flexible classroom. They attribute some of the behaviour to the physical constraints of the space itself. Their conclusions indicate that teachers and students based their behaviour during class on the classroom structure. More on-task behaviour was observed in a lecture classroom while the teacher lectured and in the flexible learning classroom while the students were engaged in an activity (Whiteside et al 2010). An interesting study by Lim et al (2012) found that the way teachers move within a space and where they stand, convey different meanings to students. For example, if a teacher stands at the front of the classroom it is an indication that the teacher is preparing to deliver important information. This is called the *Authoritative Space*. At the back of the classroom is a *Surveillance Space*. Their findings indicated that the teachers they observed spent more than 80% of their time in the *Authoritative Space* of the classroom. While there is no evidence in the study that the teachers deliberately used this technique to enhance their lesson plan it was evident that it was part of their pedagogy (Lim et al 2012).

While the previous studies provide a hopeful picture of teachers adapting their pedagogy to the physical arrangement of the classroom, many teachers experience discomfort as they consider their use of the physical space and attempt to modify their routines. As these teachers practise new teaching strategies and overcome their fears of active learning, classroom management and time management, they will begin to establish new teaching routines that will become as comfortable as their previous experiences. At the University of Wisconsin-La Crosse, Smith found that adapting new lesson plans to a teacher's comfort level helped in the transition from lecture to active learning. Teachers who like more structure can plan the questions and the activities used in class while fostering a collaborative environment. Teachers who like the flow and unpredictability of a student directed-session may just need a general outline of the concepts so they can customise the session as they teach (Smith 2004).

### 3. Classroom modifications

At BYU's Harold B. Lee Library, an undergraduate research institution of 30,000 students, IL instruction is woven throughout the various curricula. With a large instruction program of 25,000 participants in approximately 1,300 IL classroom sessions, teaching is an emphasis for many of the

university's librarians. The first-year (freshmen) composition classes represent the largest group of students (over 9,000) who receive IL training through BYU's library instruction programme.

A typical IL session for an undergraduate class includes a combination of demonstration and independent student work time. Students come to the library to meet in one of four classrooms designed for library instruction. They are seated in rows with individual desktop computers and the library instructor generally teaches at the front of the room using a stationary podium computer with their screen projected on the wall at the front of the classroom. Students are given the opportunity to follow along and if there is sufficient time during the 50-minute session, students are encouraged to do their own research with guidance from the librarian who roves the aisles.

In an effort to re-energise teaching and learning at the BYU library, a project was undertaken to modify one of four existing classrooms to provide a room that could adapt to various teaching and learning needs. The expected outcome of the changes was that student learning would improve and teachers would experience increased energy and enthusiasm in relation to their instruction sessions by integrating creative teaching approaches to the content. Teacher development efforts during the past four years focused on incorporating more student interaction in library sessions. However, many of the teachers continued to teach with traditional methods of lecture and demonstration. Changing the classroom configuration was an effort to remove barriers. Feeling constrained by the lecture-style classroom configuration, the change in environment was viewed as an opportunity to teach students in a more innovative and collaborative way which better promoted BYU's mission of providing learning in a stimulating setting.

The process of converting the classroom from its traditional layout to the envisioned flexible learning room was energising and collaborative. Utilising the people with the right expertise was vital to the success of the project. The building manager suggested innovative design ideas; his staff provided furniture samples for testing; the library technology experts provided the computer solutions that made it all work as a flexible computer classroom; enthusiastic teachers provided input on how teaching could change based on the classroom configuration; and administrators approved the changes and provided the funding. This team's creativity and willingness to implement bold ideas made for an ideal situation leading to the project's successful implementation. Figure 1 shows the changes in room configurations from a traditional classroom design to the flexible learning classroom.

Budget considerations also influenced the design of the classroom. Projects that included significant capital costs could not be considered because of funding concerns. Even though significant changes were not made to the classroom structure, funding for equipment and furniture were generous. The costs for the project included the purchase of iPads and keyboards, a charging cart and moveable furniture. In addition to the furniture and equipment costs, facilities staff had to remove the existing desks, repair the carpet, and make a few electrical changes, such as removing the power from the floor of the room and increasing the number of wall outlets. Because the physical changes to the room were not extensive, the project budget was spent on technology including the iPads, Bluetooth keyboards, charging cart (\$15,000 USD) and furniture (\$10,000 USD).

**Figure 1: Lecture and flexible learning classrooms**



**Traditional lecture classroom**



**Flexible learning classroom**

### **3.1 Modifications to classroom furniture**

The goal was to find furniture and technology that would allow students to quickly change their seating arrangement, allowing movement from one type of activity to another. With permission to replace the existing furniture, many options were considered including moveable tables, small collaborative stations and individual seats that could be moved easily. The Node chair and desk combination by Steelcase (figure 2) won the approval of those who tested it. The desk and chair combination met the design concept and allowed the most flexibility and ease of reconfiguring the room. The initial reaction by students was that the chair was comfortable and the desk had adequate space for a laptop and notebook. The Node chair is the redesign change that has received the most praise since the flexible learning classroom became operational in September 2011. The teachers who have used the flexible learning classroom value the ability to quickly create small groups, lecture anywhere in the room and easily access students who need assistance.

**Figure 2: Node chair by Steelcase**



[http://www.steelcase.com/en/products/cat\\_1](http://www.steelcase.com/en/products/cat_1)

### **3.2 Computers used in flexible learning classroom**

The vital role of technology in a successful classroom experience is illustrated by the University of Iowa's experience (Soderdahl 2011). Their experience of creating a flexible learning classroom in 2007 was labelled a failure because the technology did not work and students were spending valuable class time trying to get the computers in synch with the wireless system. The University of Iowa's experience provides three important lessons when implementing a new technology in the classroom: 1. Test the system before implementing 2. Develop a strong relationship with the technology staff 3. Simplify the experience for students and teachers (Soderdahl 2011). These lessons proved to be valuable advice when creating a flexible learning classroom at the BYU library.

One of the hurdles that had to be overcome in the classroom redesign was the technology. The devices purchased for the classroom needed to be portable with a long battery life and allow students to research as easily as they did on the desktop computers. The wireless system needed to accommodate 22 devices simultaneously connecting from the same location without noticeably slowing down the response time when loading web pages or executing a search. Also, with technology staff already supporting 1,200 computers in public and office areas, the devices used for the classroom could not require significant time for set-up or support.

Experiences from the BYU's Museum of Art provided valuable data for the decision to use the Apple iPad as the technology for the flexible learning classroom. The museum had just completed an exhibit in May 2011 using one hundred iPads for visitors to view educational videos and information about the paintings while walking around the exhibit. The exhibit was open for six months and in four months had attendance figures over 200,000. Their experiences with the iPad demonstrated that the batteries could handle a full day of use, the devices were durable, and the users were able to navigate the device with minimal instruction or intervention. Consequently, 22 iPads were purchased and the set-up was completed by the time the first class was taught in the room on 28 September 2011.

## **4. Project assessments and evaluation**

Assessments related to the classroom redesign and its success were based on need and designed to provide quick feedback. Participants were selected from library employees and students receiving IL instruction as part of their writing classes. Prior to making changes to the room most of the data gathered came from a focus group and an online survey. Once the changes were made to the classroom, the process of assessing the success of the changes became more formal and included classroom observations, library faculty interviews, and a user survey. The results formalised the anecdotal evidence that the flexible learning classroom was successful in creating more options for teaching strategies. However, the evidence also reflected that the technology better served as a personal entertainment device than an academic tool.

### **4.1 Focus group and online surveys**

Prior to making changes to remove the fixed seating and replace it with flexible furniture and handheld computers, the researchers conducted a focus group and used an online survey to determine the feasibility of replacing the personal computers with iPads. The focus group was held with twelve student library employees who volunteered to attend a 50-minute session. The student employees explored the functionality of the iPad and its use for typical research behaviours such as finding an article, using a database and navigating a website. During the last ten minutes of the session the employees were asked questions about their experience with the iPad. The second set of feedback was collected from 14 students in a first-year writing class after being taught an IL session using iPads instead of PCs. Instead of a verbal discussion of their experience, the students were asked to complete online survey about their experience.

The debriefing session with the student library employees indicated that the students enjoyed using the iPads to explore websites and do some research tasks like searching for articles but they noted that it was harder to navigate quickly. Feedback from the focus groups showed that student responses were positive about the iPad experience but hesitant about its ease of use. Many felt the iPad took longer to navigate but admitted they were not comfortable with the device and might enjoy it more once they had more experience with the navigation. One unexpected benefit of the iPad experience was discovering that a student with a learning disability felt the device enhanced her learning experience. A student with Attention Deficit Disorder (ADD) felt the device helped her to focus because she was able to do something active while following along with the database

demonstration. Further research is needed to determine if this is applicable to other students with disabilities. However, it does provide an exciting possibility for helping all students succeed in an IL instruction session.

Following the first-year writing class an online survey was sent to the students asking for their opinions regarding the use of the iPad for research. Fourteen students responded and ten students indicated they had used a tablet device such as the iPad previously. When asked about their comfort level with a tablet device, 12 students were evenly split between somewhat uncomfortable, somewhat comfortable, and completely comfortable.

## 4.2 Observations and survey

After the flexible learning classroom was completed and the room was used for the autumn semester instruction sessions, the researchers wanted to assess the impact of the change on teaching. Time constraints caused the researchers to choose two methods of assessment that were easy to implement and provided some measure of success. The first method employed observing teacher and student behaviours within 16 classroom instruction sessions. The second method was an anonymous user satisfaction survey completed by 73 students that focused on the student's interaction with the librarian during their instruction session (see Figure 3).

Sixteen classroom observations were conducted in January and February 2012. The majority of the observations were performed by the same teaching assistant. Half the observations were made in the flexible learning classroom and half in the lecture classrooms with the traditional rows of desktop computers. Where possible, the teaching assistant observed the same teachers in both rooms to determine if the room changed the teaching style and the attitudes or investment of the students in attendance. The observer noted the time spent lecturing versus the time students spent working on an instructional activity or their own research in order to measure active learning opportunities. Noise level became one of two engagement behaviours looked for during library instruction sessions. The second measure was the number of questions students asked without being prompted. It was a subjective evaluation with a noise scale that was labelled "pin drop quiet" to "sporting event loud".

The ideal outcome would have been to see a teacher decrease the amount of lecture time in the flexible learning room. Surprisingly, it was approximately 55% lecture time in both types of classrooms. The amount of lecture versus work time was fairly consistent with the teacher. If the teacher lectured in one room they tended to lecture in the flexible learning room as well. While it was surprising to observe the consistency in lecturing from room to room it was understandable since the teachers being observed generally had the largest teaching load and taught the same content multiple times a day. Routine and comfort with the material may have influenced the way a teacher taught despite the classroom environment.

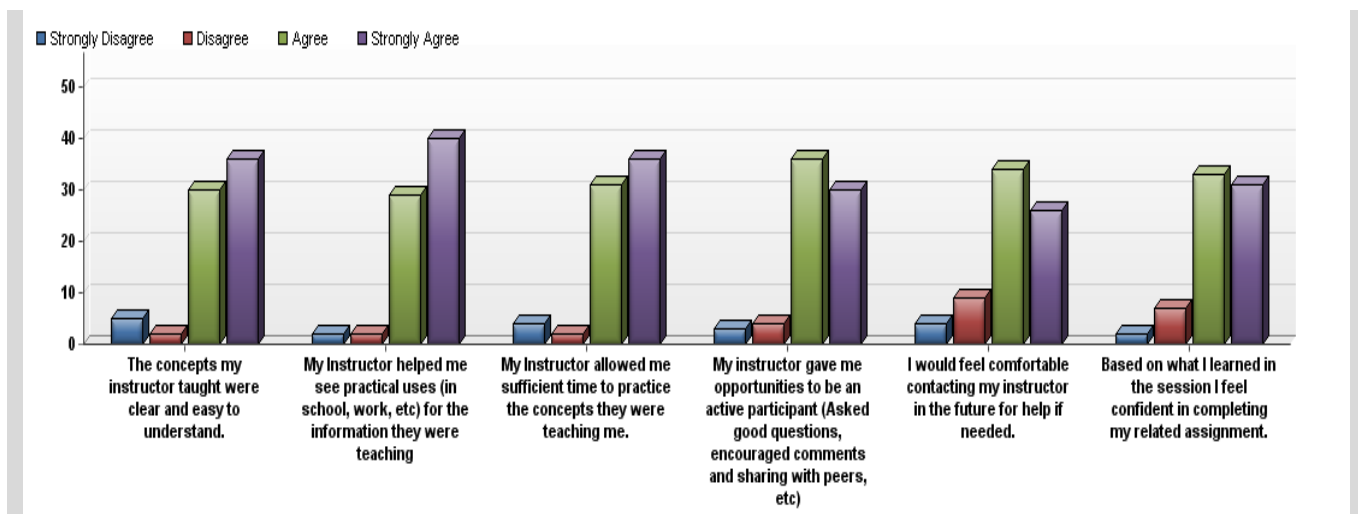
Student engagement was measured by noise spectrum and the question quantity. In the flexible learning room there were four sessions where the students were observed to be engaged at the "sporting event loud" side of the scale. This compared with two of the regular classroom sessions being evaluated at the top end of the scale. On the quiet side of the scale two classes in each room qualified for the "pin drop quiet" label. The second measure of student engagement was the number of questions that students spontaneously asked. In the flexible learning classroom there were two sessions where students asked more than one question. In the traditional classroom only one session had students asking questions. The lack of spontaneous questions from students could indicate a lack of engagement in both types of sessions. However, it may also indicate that this type of observation is ineffective in determining student engagement. In future studies alternative methods of measuring student engagement will be considered. It was also noted during



classroom observations that when the novelty of the iPad wore off, students preferred their own computers, typically laptops or netbooks, for the comfort and familiarity they provided.

One interesting finding from the observations on student engagement was that the teacher had an influence on the level of noise that occurred during the session. Students were more talkative with the same teacher no matter which room he or she taught in and students were quiet with another teacher no matter which room she taught in. The behaviour that seemed to make the most difference for student engagement was the number of interesting, open-ended questions the teacher asked. When it became evident from the observations that asking good questions and letting students talk about their research with each other led to more engaged students, one teacher integrated more questions and small group activities into his lesson plans.

**Figure 3: Student survey results – Winter 2012**



#### Survey responses from 73 students

At the end of March 2012 a satisfaction survey was sent to first-year writing students who had come to the library for instruction on research skills. Their responses were anonymous and 589 students responded to the survey. 73 responses were from students who had used the flexible learning classroom with iPads (Figure 3). When comparing results for students who received instruction in a classroom arranged in rows and students who received instruction in the flexible learning classroom, their responses were the same. Students in both groups agree or strongly agreed that their learning experiences were helpful and they were confident they could successfully complete their assignments. The results were encouraging because student satisfaction remained high in both groups. Ideally, students in the flexible learning classroom would have rated their experience as more satisfying. However, these results seem to indicate that the teacher was a more important factor in student satisfaction than the classroom arrangement. It is anticipated that future surveys will show increased student satisfaction as teachers become more comfortable with student interaction in the learning activities and the decreased amount of time spent lecturing.

#### 4.3 Librarian interviews

The teachers were the key to successful implementation of the flexible learning classroom. They made the decision when and how to use the room. It was evident from the reservations for the flexible learning classroom that only a few teachers were scheduling the room for their information literacy sessions. In an effort to understand why teachers either preferred the classroom or chose not to use the room for their instruction, interviews were held with 15 library teachers four months

after the room was operational. Their feedback revealed areas of concern with using the flexible learning classroom.

All of the teachers made the observation that they would have to teach in a different way in the flexible classroom; a traditional lecture just would not work. Those who had not used the room, 8 of the 15, felt they did not have the time to revise their curriculum. Two teachers expressed concern that the room design was just a novelty for students and they would not be as engaged with the content once the novelty wore off. One teacher who had used the room felt the room was only valuable for graduate students who were more accustomed to working in collaborative ways rather than undergraduate students. The teacher's assessment was that the students were not mature enough to respond positively to the teaching style required in a flexible classroom. A consistent concern expressed by the 15 library teachers who were interviewed was that the iPads were not an efficient tool for doing research. They felt that students were more comfortable working on a desktop computer or laptop and the iPads were too much of a technology change for the students. The majority felt that it was not the change to their teaching style that troubled them but adapting their instruction to the technology in the flexible learning room.

When using the flexible instruction room, teachers responses ranged from using the flexible classroom with no lesson plan modification to teachers who tried something different each time, modifying activities until they found something that worked. Some teachers became creative in their use of the technology as well as the flexibility of the room. One teacher used a social software program called *Conceptboard* to have students share their research topics and then comment on their peers' topics. The activity was used to effectively help students narrow their research topics. Another teacher used an iPad app that allowed participants to draw on the tablet like a sketchpad. She would ask a question and have each student write their answer on the iPad. They would hold it up and she could quickly survey the tablets to see who had answered correctly. It became both an assessment technique and a fun activity. It was encouraging to note that those who modified their teaching found the greatest satisfaction with the flexible learning classroom.

Seven library teachers who had taught in the flexible learning classroom during the semester observed benefits for their students. They noted that students were more relaxed and talkative during the flexible learning sessions. The students did not seem as solitary in relation to the research process when they had the opportunity to discuss their research with classmates. One teacher commented that more peer mentoring occurred during his sessions. Students would help their fellow students figure out how to use the iPad or how to search a database. He also felt the students produced better search results when they could talk about and share their searches with each other.

## 5. Discussion

The purpose of the project was to energise teaching and thus improve student learning. Adapting the classroom from a traditional room with fixed seating to a flexible classroom arrangement was chosen as the method for creating the environment needed to encourage teachers to use a more interactive curriculum. The findings from the classroom remodelling and subsequent assessment were that teachers are the key to successful implementation of new curriculum in a new environment. While room environment can encourage a change, the teacher is ultimately in control of when and what changes take place in the IL session. One of the most critical elements for teachers as they transitioned to the flexible learning classroom was the time and effort required to modify their curriculum to integrate more student-focused activities. The project moved at a rapid pace from concept to implementation: even the most willing teachers did not have time to adapt their lesson plans. The project was in the planning stages during the summer of 2011 and when teachers returned in the autumn of 2011 the room had been converted to a flexible learning space.

Some teachers expressed concern that in order to adapt to a new teaching environment they would have to let students have more influence on the flow of the session and the content presented if they changed from a lecture to an interactive format of teaching. Teachers liked the comfortable routine of a scripted instruction session, so not knowing what questions the students would ask or changing activities without prior preparation was an uncomfortable experience. However, as teachers created activities that allowed more student interaction, they found that the students were learning the concepts without having a lecture by the teacher. One teacher expressed it best when he said that you have to be willing to lose control in your class in order to increase student engagement and “that is a scary thing.” For those who were willing to endure the discomfort of less scripted sessions, they found rewarding interactions with students as the students asked meaningful questions and seemed more engaged in the research process. The more a teacher experienced teaching in modified classroom the more they seemed to feel comfortable and confident in using it.

Knowing that once a teacher had experienced success in the flexible learning classroom they were likely to schedule more of the instruction sessions in the room, student employees were asked to be teaching assistants and provide help with the technology and the interaction with the students. The teaching assistants’ responsibilities included arriving early to open and prepare the room for the session, help the teacher during the session, and assisting students with their questions. As students arrived, the teaching assistant issued the iPads and resolved any technology problems. During the session they used the teacher’s iPad to demonstrate the concepts as the teacher described them. The teaching assistants were also helpful in monitoring the students during the session and helping them get to the right screen if the student fell behind during the demonstration. When students were involved with collaborative projects, the teaching assistants joined the groups to help, assisted with research questions, and helped students complete their assignments. The teaching assistants proved to be a valuable partner in the success of the flexible learning classroom.

In an effort to enhance the comfort level of the teachers who might use the flexible classroom for their IL sessions, a series of training sessions were held. Teacher development training focused on methods to integrate more authentic learning activities so that the teacher did not present content solely as a lecture. As part of the training, four teachers were invited to find one IL concept they usually taught as a lecture and change it so it included an activity that involved the students. Two of the four were asked to teach in the flexible learning room and two were asked to teach in the traditional classroom. The purpose of using both rooms for the same assignment was to emphasise the idea that active learning is not dependent on the type of room, although it is easier to adapt teaching styles in the flexible learning classroom. The teachers who adapted their curriculum were asked to present their findings in training sessions held during February and March 2012. One teacher, who had not chosen to teach in the flexible learning classroom prior to this experience, found that the “benefits of the [flexible learning] room outweighed the challenges.” He has now scheduled most of his instruction sessions in the new classroom and is learning to adapt his teaching to that style of room.

Feedback from students also helped the teachers take better advantage of the new features of the room by modifying their expectations and their teaching styles. Teachers learnt to slow down, lecture less, let students explore more, and plan around the students’ needs rather than simply following the lesson plan. Connecting with classmates became one of the strengths of the flexible learning classroom. As an example, one teaching assistant overheard a group of students talking about how they didn’t really know their classmates very well even though they had been going to class together for almost two months. It was not until they had the chance to talk, move around, and work together on their research project that they really felt connected to their classmates. One young woman admitted that she had not planned to come to class that day but was happy that she had been there. Students discovered they could download and save their research and bookmark

information to their own devices, benefits that either required more time or were not possible on the iPad. Teachers who observed this behaviour began encouraging students to use their own devices specifically for those reasons.

The goal for the project was to re-energise teaching and improve student learning. While the increased use of the flexible learning classroom indicates that teachers are adapting to the new room configuration, student learning was not measured. While this is a weakness in the study there is evidence that the change in the classroom design and the adaptation of the curriculum is creating a group of teachers who are excited about interactions with students in a meaningful learning experience. It is anticipated that this excitement will lead to an improved curriculum which will benefit students.

## **6. Recommendations and lessons learnt**

Future changes to classroom environment need to take into consideration the teachers, students, and technology. Teachers need time and motivation to adapt their teaching styles and students need technical support as they adapt to new technology or procedures. Finally, technology needs to be appropriately supported with technical help and suitable for the class needs. While a flexible space can create an illusion of collaboration it will not become collaborative until the teacher designs learning activities that take advantage of the resources offered in the room, engages students in the content through social activities, and provides authentic assessments that demonstrate the students' mastery of IL skills.

Supporting new devices in a classroom setting can be a significant problem if the technology is not managed carefully. The Information Technology (IT) staff at BYU's library prepared so effectively that the first time the iPads and classroom were used everything worked seamlessly. However, prior to the successful launch of the classroom the IT staff had to spend a considerable time preparing the devices with the appropriate software and hardware. One of the most serious unanticipated problems encountered with using the iPads in the library instruction class setting was making sure each student logged out of their personal accounts before leaving the session. Students who accessed their Facebook or email account during a session and did not log out at the end of class would still be logged in the next time the iPad was used. No automated solution has been found yet to resolve this problem, so teachers remind students to log out of their accounts at the end of class and the teaching assistants are taught how to clear personal data from the device.

Supporting students as they use the iPads was addressed by having a library trained teaching assistant attend each library instruction session. During the session, student teaching assistants provided support for each teacher by checking the devices in and out, helping the students resolve computer problems, helping the teacher run the technology, and providing peer research coaching during open work time. These processes could take a significant portion of class time, but the teaching assistant facilitated the technology needs so that the disruptions did not interfere with the instruction time. Students who choose to use their own laptops or tablet devices for the class sessions rather than the iPad have not had any problems connecting their devices to the wireless system or doing any of the class activities. If the student does encounter a problem with their device, they are given an iPad to use during the session. This prevents class time from being disrupted by technology concerns.

The challenge for converting a classroom to a more flexible space is identifying the value of the change. If students benefit from the new classroom environment by showing improved IL skills then the investment in time and money to convert the classroom to a flexible learning space is a wise step. Knowing how to assess changes in student behaviour is the complexity of this issue.

Improvement in student IL skills may be attributed to both the environment and the teacher. In order to determine which has the greatest effect, additional study is needed to assess the impact of the classroom environment on student learning in an IL instruction session. The research suggests that the teacher's method of instruction influences student satisfaction and their behaviour during the instruction session more than the arrangement of the classroom. Therefore, future studies of this topic should include a qualitative analysis of the teacher's performance in both a flexible learning and a lecture form of classroom. The analysis of the data will provide important information regarding the impact of the classroom environment on student satisfaction and IL skill development.

## 7. Conclusion

The purpose of this study was to explore the connection between classroom configuration and teaching methods. Research studies suggested that students desired a collaborative learning environment (Appleton et al 2011) and that the class design did affect their social connections with each other (Burgess and Kaya 2007). Additional studies indicate that teachers are influenced by the classroom design and will adapt their lessons to the configuration of the room (Whiteside et al 2010). The research implies that changing the classroom seating from static to flexible will have a positive impact on teacher and student behaviour. This is also evident in the unique instruction that is offered in an IL classroom where the library teacher has only a few hours to teach important research skills. The constraints of the classroom environment influence the way the teacher prepares and presents a lesson.

The study conducted at BYU provides additional evidence that changing the classroom environment for IL instruction can have a positive impact on teacher and student behaviour. By changing the seating in one classroom from fixed to moveable furniture and providing students with iPads the routine was disrupted. Teachers adapted to this disruption by experimenting with their lesson plans and incorporating more interactive activities. Energising teaching begins with a teacher's enthusiasm to modify his or her curriculum. Changing the classroom environment in this instance was the catalyst teachers needed to integrate new pedagogical practices. Though a lecture-based teaching style can be efficient and safe, it is not what most students in this technology-driven age need and initial results indicate that students responded positively to the changes.

While this study is limited in its design and scope, it provides a hopeful voice among the other research studies that teaching and learning can be positively impacted by small changes to the classroom environment. Teachers are vital to the success of a classroom redesign and providing them with the time to adapt to the new classroom and examples of successful changes provides energy in the library instruction program that will increase student satisfaction with their IL instruction. The room truly becomes a flexible learning space when students and teachers are actively engaged in learning.

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